

ABSTRACT

A new method and apparatus to produce drops with diameters several tens of nanometers and/or positive or negative ions with a wide range of chemical composition and masses as large as several kiloDalton is based on creating Taylor cone-jets of high electrical conductivity, moderate viscosity, and low volatility liquids under reduced pressure. The liquid is supplied at a controlled flow rate into a region at low pressure exposed to an electric field sufficient to electrically atomize it. Suitably charged, shaped and placed electrodes create the necessary electric field to form the Taylor cone and extract the charged particles it produces, with a desired energy and direction. Subsequent ion manipulation supplies beams of ions and/or nanoparticles for applications such as electrical propulsion or surface treatment. No liquids suitable to practice this invention have been known in the past and are introduced here as a key aspect of the invention. They are such as electrolytes of formamide (or organic liquids such as amides, alcohols, glycols, esters, ketones, organic phosphates or carbonates, etc., and mixtures of one or more of these components), ionic liquids (neat or mixed with other ionic liquids, molecular solvents and/or salts), molten salts and inorganic acids.